

SUBMARINE EXTERIOR COMMUNICATIONS SYSTEM (SubECS)



Navy Program (no ACAT)

Total Number of Systems:	68
Total Program Cost (TY\$):	\$689M
Average Unit Cost (TY\$):	\$12M
Full-rate production:	
Phase 1:	4QFY01
Phase 2:	4QFY03
Phase 3:	4QFY05
VIRGINIA ECS:	4QFY07

Prime Contractor

Various

SYSTEM DESCRIPTION & CONTRIBUTION TO JOINT VISION 2010

The Submarine Exterior Communications System (SubECS) is an umbrella program that integrates fifteen smaller acquisition programs and Commercial Off-the-Shelf (COTS) components into a system intended to support Network Centric Warfare. The goal of this effort is a communications system that is common across all submarine classes, and compatible/interoperable with planned DoD C⁴I infrastructure.

SubECS supports *information superiority* by improving data throughput to and from the submarine using new antennas, new transceivers, and new waveforms. SubECS will also incorporate key information technologies and accommodate joint tactical and targeting databases, including IT-21 and

Joint Deployable Intelligence System, to ensure that the submarine force is a major contributor to *dominant maneuver, precision engagement, and full-dimensional protection*.

BACKGROUND INFORMATION

SubECS upgrades the communications systems of all existing submarines (SSN 688 Class, SEAWOLF Class, and TRIDENT Class) and is being fielded in three major phases. Phase 1 will provide increased interoperability, data rate, and throughput to the submarine; Phase 2 will provide enhanced message processing and distribution; and Phase 3 will replace remaining legacy transceivers and cryptographic hardware with digital modular radios and programmable modular cryptographic solutions. During these phases, software and hardware upgrades to equipment from previous phases will be implemented as necessary to keep up with commercial technologies. By Phase 3, a functionally common radio room baseline will exist for all in-service submarine classes. The VIRGINIA Class (SSN 774) Exterior Communications System (ECS) is being developed and integrated as part of new construction utilizing the construction shipyard as the integrator. The VIRGINIA ECS will build on SubECS Phase 3, and is essentially Phase 4 of SubECS. The goal for the out-years is that all in-service submarines will be upgraded to VIRGINIA ECS, maintaining a common and state-of-the-art radio room on all submarine classes.

The test concept for SubECS involves IOT&E for each smaller sub-component, as well as an end-to-end system test for each major phase. Each sub-component program will continue to undergo OT&E as it is introduced into the Fleet. To ensure the end-to-end connectivity and system operational requirements are met, each phase will undergo a land-based OA and land-based Technical Evaluation (TECHEVAL), which will be used to certify the system for installation on a submarine. Subsequent to installation, each phase will undergo an at sea TECHEVAL (for those tests not completed in the land-based radio room) and an OPEVAL. The VIRGINIA Class ECS land-based testing will occur in the VIRGINIA Combat Control System Module Off-hull Assembly and Test Site as part of VIRGINIA's OT-IIB OA, and will undergo an at sea OPEVAL concurrent with overall VIRGINIA (SSN 774) OPEVAL.

To further reduce VIRGINIA ECS risk and ensure that Battle Group and Joint Interoperability are supported, unique sub-components from VIRGINIA ECS are being evaluated for possible early at sea testing as part of SubECS Phase 2 and Phase 3.

TEST & EVALUATION ACTIVITY

All in-service submarine ECS systems have satisfactorily completed Y2K certification.

DOT&E reported last year that the Navy was staffing the Capstone TEMP, which had been expected to reach DOT&E for approval by late 1998. At report submission, the Navy was still staffing the TEMP at the Service Acquisition Executive and Chief of Naval Operations levels. So far, the SubECS Capstone TEMP represents a more than three-year effort by DOT&E and the Navy to achieve a focused, overall SubECS program test strategy.

No system level OT&E has occurred in the SubECS program. The first SubECS system level OT&E is currently scheduled for late FY00. FY99 program funding cuts have delayed system level OT&E by one year, and may delay it further.

In FY99, satisfactory OT&E occurred on the following SubECS sub-components:

- The Submarine Low Frequency (LF)/Very Low Frequency (VLF) Versa Module European Bus (VMEbus) Receiver (SLVR), a component subsystem that supports LF and VLF communications.
- The Submarine Baseband Communication Switch, a component subsystem that automatically connects radios, legacy cryptographic equipment, and input/output devices.
- The Miniaturized Demand Assigned Multiple Access transceiver, a component subsystem that supports Ultra High Frequency (UHF) communications.
- The OE-538 Multifunction Antenna, which supports LF, HF, VHF, UHF and L-Band communications.

A satisfactory land based Developmental Test of the Submarine High Data Rate (SubHDR) Antenna, which supports Extremely High Frequency, Low Data Rate and Medium Data Rate, Super High Frequency, and Global Broadcast System communications, was completed in late FY99.

In a related Navy-wide test, an OPEVAL of the Global Command and Control System Maritime system, which provides a common tactical and operational picture to the warfighters, occurred in late FY99. Test results will be available in FY00.

SubECS sub-component OT&E pending for FY00 include SubHDR, the Digital Modular Radio, and the Automated Digital Network System.

TEST & EVALUATION ASSESSMENT

The continued delay in the Navy's submission of the TEMP for DOT&E approval suggests a lack of submarine force commitment to a comprehensive end-to-end test strategy for SubECS.

OT&E was conducted on SCSS sub-components in accordance with their individual Navy-controlled TEMPs, but no SubECS integrated phase tests occurred in FY99 due to budget cuts to the SubECS program and due to the lack of an approved Capstone TEMP. Of note, all OT&E in FY99 was successful. The first integrated test (Phase 1) should occur in FY00, pending approval of the Capstone TEMP.

The most significant event in the SubECS program in FY99 was the consolidation of the in-service submarine ECS backfit program with the VIRGINIA ECS new construction program under a single program manager, directly accountable to the Program Executive Officer for Submarines. This arrangement should reduce risk across the board and enable the Navy to more efficiently achieve a common submarine ECS architecture within the next decade. Driven by the need to reduce costs, this realignment is part of a larger Navy effort to rearrange its submarine acquisition and engineering support functions wherever possible along functional instead of submarine hull-specific lines. This arrangement also allows the SubECS program to leverage VIRGINIA program funds.

The introduction of a SubECS Capstone TEMP will provide VIRGINIA and in-service submarines with a framework in which formal communications system requirements can be addressed,

but it remains to be seen how well discipline can be maintained in the current unsettled communications environment. The Navy's C⁴I acquisition practices, with shorter and shorter generation cycles to employ state-of-the-art communications capabilities, have caused much instability. Configuration management in such a C⁴I environment is a daunting challenge, particularly with the introduction of COTS.

The FY98 annual report cited the VIRGINIA ECS as high risk, with concerns about interoperability, the high rate of change in the Navy's C⁴I acquisition practices, short acquisition cycles, and reduced equipment rack space. To mitigate such risks, the VIRGINIA ECS program implemented a phased delivery approach that delays the selection of a final configuration as long as possible to reduce changes, both anticipated and unanticipated, in the Navy's C⁴I acquisition programs. VIRGINIA's limited ECS space, nine racks versus fourteen on SSN 688, also makes it important to delay VIRGINIA's final configuration as long as possible to take better advantage of the latest technological miniaturization developments. The recent alignment of the SubECS back-fit program and the VIRGINIA ECS new construction program under a single program manager should reduce risk by simplifying managerial decisions and getting portions of VIRGINIA ECS to sea for early operational assessment. Based on these changes, DOT&E now evaluates the current VIRGINIA ECS risk as moderate.

DOT&E continues to monitor and work with the SubECS program office, the sponsors (OPNAV N87 and N61), and both the SEAWOLF and VIRGINIA programs to maintain focus on submarine C⁴I system of systems testing. As predicted last year, budget restrictions are forcing a less ambitious submarine radio room acquisition program so adequate funding for system engineering and testing remain a watch item.

CONCLUSIONS, RECOMMENDATIONS, LESSONS LEARNED

COTS products often are neither "commercial" nor "off the shelf" and require considerable development for military use. Also, COTS products may be subjected to military environments never contemplated by the designer. For this reason, testing of COTS products must stress those systems under expected military loading. Additionally, although the use of COTS products in communications systems has the potential to provide the Fleet with needed capability quickly, its use should not come at the cost of inadequate logistics, poor training, and erroneous documentation. Disciplined land-based testing prior to fleet installation, with close attention to training and maintenance documentation, has resulted in improved test performance during FY99.